HR-350 Flood-Plain and Channel Aggradation as Selected Bridge Sites in the Iowa and Skunk River Basins, Iowa

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ABSTRACT

Flood-plain and channel-aggradation rates were estimated at selected bridge sites in central and eastern Iowa using four aggradation-measurement methods. Aggradation rates were quantified at 10 bridge sites on the Iowa River upstream of Coralville Lake and at two bridge sites in the central part of the Skunk River Basin. Measurement periods used to estimate average aggradation rates ranged in length from 1 to 98 years and varied among methods and sites.

A dendrogeomorphic-measurement method used tree-age data and sediment-deposition depths to estimate flood-plain aggradation rates; mean rates calculated at the 12 bridge sites ranged from 0.013 to 0.051 feet per year, and median rates ranged from 0.010 to 0.046 feet per year. A bridge-opening cross-section measurement method compared historic and recent cross-section of bridge openings to estimate aggradation rates at bridge openings; Average sates at the 12 bridge sites ranged from –0.977 to 0500 feet per year. A stage-discharge rating-curve measurement method comparing historic and recent stages for selected discharge used the 5-year flood discharge to estimate floodway – (flood-plain and channel) aggradation rates and used the average discharge to estimates channel-aggradation rates. Average rates calculated for selected measurements periods at six of the bridge sites ranged from –0.028 to 0.298 feet per year for the 5-year flood discharge, and from –0.031 to 0.108 feet per year for the average discharge. Nine sediment pads installed on the Iowa River flood plain at three bridge sites in the vicinity of Marshalltown, prior to overbank flooding in1993, were used to measure sediment-deposition depths and to estimate flood-plain aggradation rates resulting from the 1993 flood and for the period 1993-94. Average rates estimated from the sediment-pad measurements ranged from 0.037 to 1.100 feet per year for 1993, and from 0.038 to 0.579 feet per year for the period 1993-94. Sediments deposited on the pads as a result of the 1993 flood ranged in depth from 0.004 to 2.95 feet.

A direct comparison cannot be made between aggradation rates calculated using each of the four measurement methods because of differences in time periods and aggradational processes that were measured by each method. Each of the four aggradation-measurement methods is useful for obtaining specific types of aggradation information and each method is considered applicable for specific types of regional investigations. The rating-curve method might provide the most useful information concerning floodway and channel aggradation, but rating-curve information only is available at streamflow-gaging stations with chronology of state discharge rating curves. The bridge-opening cross-section method does not provide direct measurements of flood-plain or channel aggradation, but this method does provide useful information concerning possible changes in the flow capacity of bridge openings.

The highest aggradation rates calculated for the Iowa River Basin using the dendrogeomorphic and rating-curve measurement methods were for State Highway 14 crossing at Marshalltown, where the highest rates were 0.045 and 0.124 feet per year, respectively. The highest aggradation rates calculated for the Skunk River Basin were for the U.S. Highway 63 crossing the South Skunk River near Oskaloosa, where these highest rates were 0.051 and 0.298 feet per year, respectively. The similar aggradation rates calculated for both the Marshalltown and Oskaloosa bridge sites using each measurement method, the dendrogeomorphic method and rating-curve method for the 5-year flood discharge, indicate that similar flood-plain and flood way aggradation processes might be occurring at the two sites.

Several interrelated factors might be contributing to the relatively high rate of aggradation the Iowa River at Marshalltown. Erosion in the Marshall County are might contribute high sediment to the Iowa River, and channelization of the Iowa River upstream of Marshalltown might contribute to higher sediment loads in the Iowa River in the Marshalltown area. At Marshalltown, where the Iowa River changes abruptly from a straightened channel to a meandering channel, flow velocities decrease as the channel gradient decreases, educing the sediment-transport capacity of the river. Information on recent aggradation rates indicates that the Iowa River at Marshalltown might be aggrading at a rate greater than that calculated for longer measurement periods. A trend of increasing streamflow for the Iowa River at Marshalltown combined with an aggradation channel might be causing more frequent overbank flows and increased flood-plain aggradation.